TENTATIVE PARCEL MAP
HYDROLOGY STUDY
for

Department Planning and Land Use
County of San Diego, CA

PREPARED FOR:
Chris Kirkorowicz
Kirkorowicz Family Partnership/ LP

PREPARED BY:
Pasco Engineering, Inc.

DATE:
August 16, 2006

W. Justin 9/25/09

W. JUSTIN SUITER, RCE 68964 DATE

This Drainage Study has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

W. Justin Suiter
REGISTERED CIVIL ENGINEER

9/25/09
DATE

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

This Hydrology Study for the Kirkorowicz Property has been prepared to analyze the hydrologic characteristics of the existing and proposed project site, and determine the existing condition offsite hydrologic characteristics that are conveyed through the proposed project site. This report intends to present the methodology and the calculations used for determining the runoff from the project site in both the pre-developed (existing) conditions and the post-developed (proposed) conditions, as well as the offsite areas, produced by the 100 year 6 hour storm.

1.2 Existing Conditions

The project site is located on the southern edge of Gopher Canyon, south of Gopher Canyon Road, and East of the San Luis Rey River. Access to the site is via Fairview Drive. The site lies within the southwest corner of Section 32 of Township 10 South, Range 3 West of the San Bernardino Base and Meridian; USGS 7.5' Bonsall, California Quadrangle.

The project site consists of flat and relatively steep terrain with drainage running through the north-central portion of the property. The on-site drainage is part of a tributary to Little Gopher Canyon Creek. The maximum elevation is approximately 465 feet above mean sea level (MSL), while the low elevation is approximately 300 feet above MSL. The existing site has been utilized for agricultural purposes.

Drainage of the existing site is conveyed via two natural unnamed tributaries of the Little Gopher Canyon Creek, which originate in the north-central portion of the site and southeast of the site. One tributary meanders around the northern perimeter of the site to the northeastern portion of the site. The other follows the eastern property line to the northeastern portion of the site.

1.3 Proposed Project

The intent of the proposed project is to develop the project site into two detached single-family dwellings. The project design proposes to construct improvements, which include improving an existing private street to provide access to each individual single-family residential lot, and the construction of typical underground utilities associated with residential development. The proposed project design will also include grading of the site to provide two graded pads, suitable for the construction of residential structures and associated driveways.

There will not be a storm drain system design associated with the project. The project site will utilize the swales and ditches in order to convey the runoff over existing natural grade. The development will not directly discharge into any environmentally sensitive areas. Stormwater from the pads will outlet onto natural grade and will course easterly

through the site prior to reaching the unnamed tributaries. Stormwater from the private street will also meander through the site over natural grade prior to reaching the natural tributaries.

Storm water generated on-site, with the exception of the water that is tributary to the two above described inlets, flows in a northeasterly manner. On-site runoff will initially sheet flow and either then be conveyed in a street gutter or overland until it confluences with an existing natural channel.

Storm water discharged from the project site is not anticipated to disrupt the natural downstream drainage course. The peak discharge from the site will be mitigated and reduced to a value equal to or less than that of the existing condition; therefore the potential for erosion related to an increase peak flow and an overburdening of the downstream systems is reduced and negligible. Based on field observations of the downstream channel, it appears that the channel has historically experienced significant flows for extended periods of time. The resultant of which is that the channel and its surroundings have been formed in a manner enabling it to convey high flows and therefore no significant impacts resulting from the development of the proposed project site are anticipated.

1.4 Summary of Results

Upon performing hydrologic analysis of the project site in both the proposed developed condition and existing condition the following results were produced. In both conditions the hydrologic model included the analysis of the project site at two ultimate points of discharge. Output data from the hydrologic analysis model of the tributary area 1, to the north-central portion of the project site, in the existing condition indicates that the 100-year peak runoff flow of 11.65 cfs, with a tributary area of 5.82 acres. Output data from the hydrologic analysis model of the tributary area 1, to the north-eastern corner of the project site, in the existing condition indicates that the 100-year peak runoff flow of 5.14 cfs, with a tributary area of 3.00 acres. These points of discharge are not impacted by the proposed project design and the hydrologic characteristics of this off-site area are uniform between the two conditions analyzed.

Output data from the hydrologic analysis model of the tributary area 4, to the north-central portion of the project site, in the existing condition indicates that the 100-year peak runoff flow of 10.75 cfs, with a tributary area of 4.77 acres. Output data from the hydrologic analysis model of the tributary area 3, to the north-eastern corner of the project site, in the existing condition indicates that the 100-year peak runoff flow of 8.06 cfs, with a tributary area of 4.03 acres. The difference in peak runoff flow from the existing to developed condition is an increase of 2.02 cfs.

1.5 Conclusions

The proposed development will slightly increase the amount of runoff from the project site as compared to the runoff from the site in the existing conditions. Due to the impact

of the increase in impervious area resulting from the proposed project design, the peak storm water runoff flow from the 7.2 acre project site will increase by 2.02 cfs. This minor increase corresponds to an increase of 10% from the existing condition.

To ensure that all storm water treatment goals are addressed, the project site design proposes to utilize grass-lined swales as a post construction BMP.

1.6 References

"San Diego County Hydrology Manual", revised June 2003, County of San Diego, Department of Public Works, Flood Control Section.

2.0 METHODOLOGY

2.1 Introduction

The hydrologic model used to perform the hydrologic analysis presented in this report utilizes the Rational Method (RM) equation, Q=CIA. The RM formula estimates the peak rate of runoff based on the variables of area, runoff coefficient, and rainfall intensity. The rainfall intensity (I) is equal to:

$$I = 7.44 \times P_6 \times D^{-0.645}$$

Where:

I = Intensity (in/hr)
P_6 = 6-hour precipitation (inches)
D = duration (minutes – use Tc)

Using the Time of Concentration (Tc), which is the time required for a given element of water that originates at the most remote point of the basin being analyzed to reach the point at which the runoff from the basin is being analyzed. The RM equation determines the storm water runoff rate (Q) for a given basin in terms of flow (typically in cubic feet per second (cfs) but sometimes as gallons per minute (gpm)). The RM equation is as follows:

$$Q = CIA$$

Where:

Q= flow (in cfs)
C = runoff coefficient, ratio of rainfall that produces storm water runoff (runoff vs. infiltration/evaporation/absorption/etc)
I = average rainfall intensity for a duration equal to the Tc for the area, in inches per hour.
A = drainage area contributing to the basin in acres.

The RM equation assumes that the storm event being analyzed delivers precipitation to the entire basin uniformly, and therefore the peak discharge rate will occur when a raindrop that falls at the most remote portion of the basin arrives at the point of analysis. The RM also assumes that the fraction of rainfall that becomes runoff or the runoff coefficient C is not affected by the storm intensity, I, or the precipitation zone number.

Based on the USDA survey, the soils classification for the site is soils classification "D".

2.2 County of San Diego Criteria

As defined by the County Hydrology Manual dated June 2003, the rational method is the preferred equation for determining the hydrologic characteristics of basins up to approximately one square mile in size. The County of San Diego has developed its own tables, nomographs, and methodologies for analyzing storm water runoff for areas within the county. The County has also developed precipitation isopluvial contour maps that show even lines of rainfall anticipated from a given storm event (i.e. 100-year, 6-hour

storm). The 100-year 6-hour storm event isopluvial map for the project site is included on the following page.

One of the variables of the RM equation is the runoff coefficient, C. The runoff coefficient is dependent only upon land use and soil type and the County of San Diego has developed a table of Runoff Coefficients for Urban Areas to be applied to basin located within the County of San Diego. The table categorizes the land use, the associated development density (dwelling units per acre) and the percentage of impervious area. Each of the categories listed has an associated runoff coefficient, C, for each soil type class.

The County has also illustrated in detail the methodology for determining the time of concentration, in particular the initial time of concentration. The County has adopted the Federal Aviation Agency's (FAA) overland time of flow equation. This equation essentially limits the flow path length for the initial time of concentration to lengths of 100 feet or less, and is dependent on land use and slope.

2.3 Runoff Coefficient Determination

As stated in section 2.2, the runoff coefficient is dependent only upon land use and soil type and the County of San Diego has developed a table of Runoff Coefficients for Urban Areas to be applied to basin located within the County of San Diego. The table, included at the end of this section, categorizes the land use, the associated development density (dwelling units per acre) and the percentage of impervious area.

For the proposed development the total number of dwellings proposed is two, and the total lot area is roughly equal to 7.2 acres. This corresponds to a dwelling unit per acre (DU/A) ratio of 0.28. Therefore the runoff coefficient of 0.41, which corresponds to DU/A of 1.0 or less and an impervious ratio of 10% was chosen. For the offsite area to the north, a runoff coefficient of 0.35 was selected. In a couple of instances a runoff coefficient of 0.38 was used because the sub-area being analyzed included both existing natural land and proposed development.

For the existing conditions, runoff coefficients were selected based upon the impervious percentage and land use. The coefficient utilized was 0.35.

3.0 HYDROLOGY MODEL OUTPUT

3.1 Pre-Developed Hydrologic Model Output

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           RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2001,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2002 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2002  License ID 1452

                          Analysis prepared by:

                         Pasco Engineering, Inc.
                         535 N. HWY 101, Suite A
                          Solana Beach, CA 92075


 ************************** DESCRIPTION OF STUDY **************************
* Predevelopment Hydrology Analysis for the 100 Year Storm                *
* Fairview Drive, Bonsall, CA                                             *
* Kirkorowicz - PE 1104                                                   *
 **************************************************************************

  FILE NAME: 1104PRE.DAT
  TIME/DATE OF STUDY: 14:23 08/17/2006
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  1985 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SPECIFIED CONSTANT RUNOFF COEFFICIENT = 0.350
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE      1.20 TO NODE      1.10 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(GLOBAL):
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH =   100.00
  UPSTREAM ELEVATION =    470.00
  DOWNSTREAM ELEVATION =    457.00
  ELEVATION DIFFERENCE =     13.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MINUTES) =    5.742
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MINUTES
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.027
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 SUBAREA RUNOFF(CFS) =      0.54
 TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
 FLOW PROCESS FROM NODE      1.10 TO NODE      1.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    457.00  DOWNSTREAM(FEET) =    335.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   676.00   CHANNEL SLOPE =  0.1805
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      0.54
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.38   Tc(MIN.) =   8.38
 LONGEST FLOWPATH FROM NODE      1.20 TO NODE      1.00 =   776.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.667
 *USER SPECIFIED(GLOBAL):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    5.60   SUBAREA RUNOFF(CFS) =   11.11
 TOTAL AREA(ACRES) =     5.82   TOTAL RUNOFF(CFS) =   11.65
 TC(MIN) =   8.38

+--------------------------------------------------------------------------+
| end of tributary 1                                                       |
| begin of tributary 2                                                     |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE      2.20 TO NODE      2.10 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(GLOBAL):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH =   100.00
 UPSTREAM ELEVATION =    470.00
 DOWNSTREAM ELEVATION =    461.00
 ELEVATION DIFFERENCE =      9.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MINUTES) =    6.491
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.680
 SUBAREA RUNOFF(CFS) =      0.14
 TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.14

****************************************************************************
 FLOW PROCESS FROM NODE      2.10 TO NODE      2.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    461.00  DOWNSTREAM(FEET) =    295.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1180.00   CHANNEL SLOPE =  0.1407
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      0.14
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   4.15   Tc(MIN.) =  10.64
 LONGEST FLOWPATH FROM NODE      2.20 TO NODE      2.00 =  1280.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.857
 *USER SPECIFIED(GLOBAL):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    2.94   SUBAREA RUNOFF(CFS) =    5.00
 TOTAL AREA(ACRES) =     3.00   TOTAL RUNOFF(CFS) =    5.14
 TC(MIN) =  10.64
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =      3.00  TC(MIN.) =     10.64
 PEAK FLOW RATE(CFS)    =      5.14
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

3.2 Post-Developed Hydrologic Model Output

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           RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2001,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2002 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/2002  License ID 1452

                          Analysis prepared by:

                         Pasco Engineering, Inc.
                         535 N. HWY 101, Suite A
                          Solana Beach, CA 92075


 ************************** DESCRIPTION OF STUDY **************************
* Postdevelopment Hydrology Analysis for the 100 Year Storm                *
* Fairview Dr, Bonsall, CA                                                 *
* Kirkorowicz - PE 1104                                                    *
 **************************************************************************

  FILE NAME: 1104POST.DAT
  TIME/DATE OF STUDY: 14:48 08/17/2006
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  1985 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  ===== ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE      3.40 TO NODE      3.30 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH =   100.00
  UPSTREAM ELEVATION =    470.00
  DOWNSTREAM ELEVATION =    457.00
  ELEVATION DIFFERENCE =     13.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MINUTES) =    5.742
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MINUTES
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.027
 SUBAREA RUNOFF(CFS) =      0.54
 TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
 FLOW PROCESS FROM NODE      3.30 TO NODE      3.20 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    457.00  DOWNSTREAM(FEET) =    411.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   380.00   CHANNEL SLOPE =  0.1211
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      0.54
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.34   Tc(MIN.) =   7.34
 LONGEST FLOWPATH FROM NODE      3.40 TO NODE      3.20 =   480.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.20 TO NODE      3.20 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.173
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =  0
 SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    1.51
 TOTAL AREA(ACRES) =     0.92   TOTAL RUNOFF(CFS) =    2.05
 TC(MIN) =   7.34

****************************************************************************
 FLOW PROCESS FROM NODE      3.20 TO NODE      3.10 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    411.00  DOWNSTREAM(FEET) =    325.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   632.00   CHANNEL SLOPE =  0.1361
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      2.05
 FLOW VELOCITY(FEET/SEC) =   5.47 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.92   Tc(MIN.) =   9.26
 LONGEST FLOWPATH FROM NODE      3.40 TO NODE      3.10 =  1112.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.10 TO NODE      3.10 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.312
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3800
 S.C.S. CURVE NUMBER (AMC II) =  0
 SUBAREA AREA(ACRES) =    1.90   SUBAREA RUNOFF(CFS) =    3.84
 TOTAL AREA(ACRES) =     2.82   TOTAL RUNOFF(CFS) =    5.89
 TC(MIN) =   9.26

****************************************************************************
 FLOW PROCESS FROM NODE      3.10 TO NODE      3.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    325.00  DOWNSTREAM(FEET) =    295.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   230.00   CHANNEL SLOPE =  0.1304
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      5.89
 FLOW VELOCITY(FEET/SEC) =   6.94 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.55   Tc(MIN.) =   9.81
```

```
 LONGEST FLOWPATH FROM NODE      3.40 TO NODE      3.00 =  1342.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.117
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =  0
 SUBAREA AREA(ACRES) =    1.21   SUBAREA RUNOFF(CFS) =    2.17
 TOTAL AREA(ACRES) =     4.03   TOTAL RUNOFF(CFS) =    8.06
 TC(MIN) =   9.81

+----------------------------------------------------------------------------+
| end of tributary 3                                                         |
| begin of tributary 4                                                       |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE      4.40 TO NODE      4.30 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =  0
 INITIAL SUBAREA FLOW-LENGTH =  100.00
 UPSTREAM ELEVATION =    465.00
 DOWNSTREAM ELEVATION =    451.00
 ELEVATION DIFFERENCE =     14.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MINUTES) =    5.602
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MINUTES
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.027
 SUBAREA RUNOFF(CFS) =      0.30
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
 FLOW PROCESS FROM NODE      4.30 TO NODE      4.20 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    451.00  DOWNSTREAM(FEET) =    403.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   223.00   CHANNEL SLOPE =  0.2152
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      0.30
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.78   Tc(MIN.) =   6.78
 LONGEST FLOWPATH FROM NODE      4.40 TO NODE      4.20 =   323.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.20 TO NODE      4.20 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.492
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3800
 S.C.S. CURVE NUMBER (AMC II) =  0
 SUBAREA AREA(ACRES) =    1.56   SUBAREA RUNOFF(CFS) =    3.85
 TOTAL AREA(ACRES) =     1.68   TOTAL RUNOFF(CFS) =    4.14
 TC(MIN) =   6.78

****************************************************************************
 FLOW PROCESS FROM NODE      4.20 TO NODE      4.10 IS CODE =  52
```

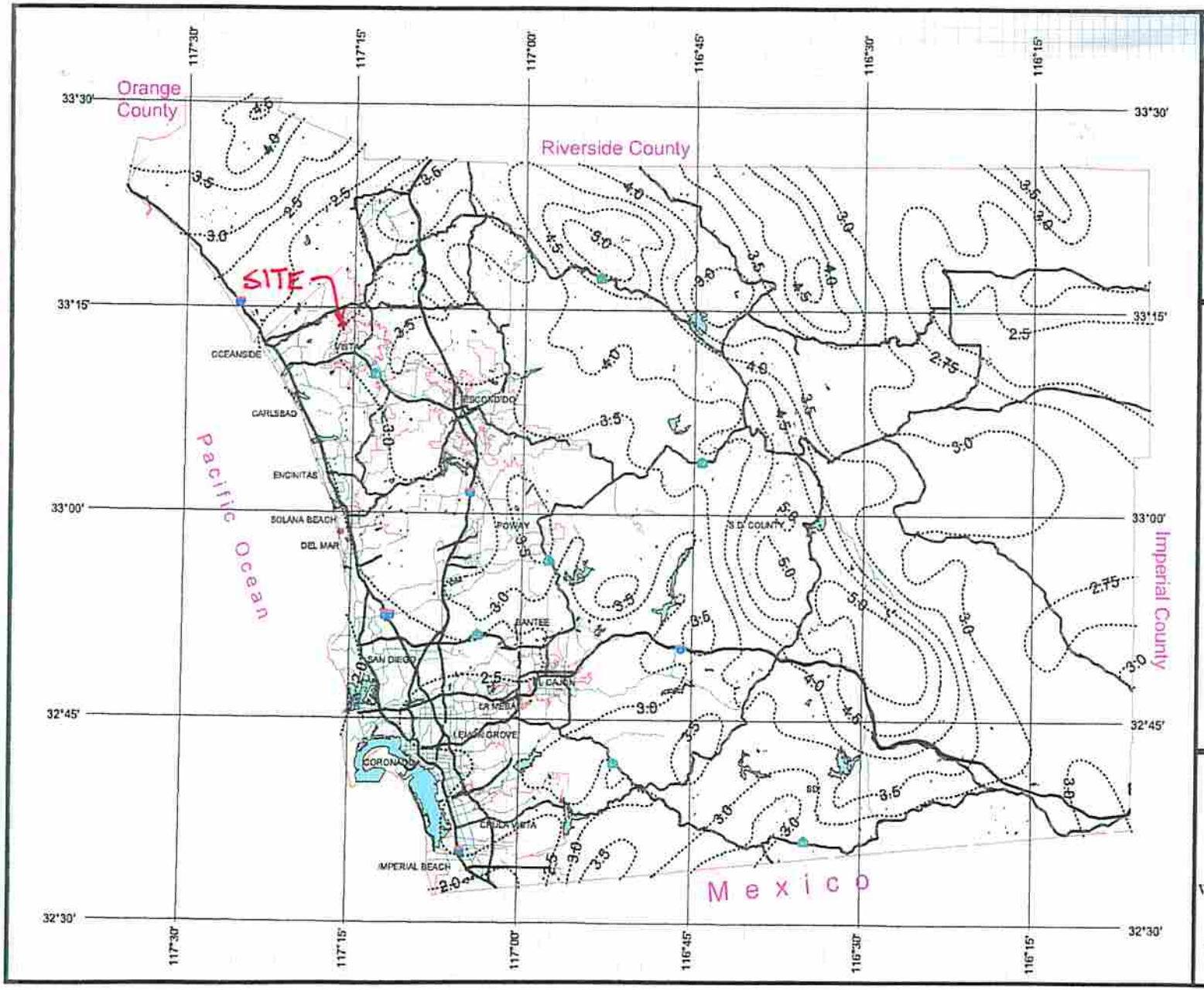
```
------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    403.00  DOWNSTREAM(FEET) =    359.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   295.00   CHANNEL SLOPE =  0.1492
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       4.14
 FLOW VELOCITY(FEET/SEC) =   6.39 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.77   Tc(MIN.) =   7.55
 LONGEST FLOWPATH FROM NODE      4.40 TO NODE      4.10 =   618.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.10 TO NODE      4.10 IS CODE =  81
------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.057
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    2.07   SUBAREA RUNOFF(CFS) =    4.39
 TOTAL AREA(ACRES) =     3.75   TOTAL RUNOFF(CFS) =    8.53
 TC(MIN) =   7.55

****************************************************************************
 FLOW PROCESS FROM NODE      4.10 TO NODE      4.00 IS CODE =  52
------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    359.00  DOWNSTREAM(FEET) =    335.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   137.00   CHANNEL SLOPE =  0.1752
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       8.53
 FLOW VELOCITY(FEET/SEC) =   7.59 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.30   Tc(MIN.) =   7.85
 LONGEST FLOWPATH FROM NODE      4.40 TO NODE      4.00 =   755.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.907
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3800
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.60   SUBAREA RUNOFF(CFS) =    1.35
 TOTAL AREA(ACRES) =     4.35   TOTAL RUNOFF(CFS) =    9.88
 TC(MIN) =   7.85

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.907
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =    0.42   SUBAREA RUNOFF(CFS) =    0.87
 TOTAL AREA(ACRES) =     4.77   TOTAL RUNOFF(CFS) =   10.75
 TC(MIN) =   7.85
========================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =      4.77  TC(MIN.) =      7.85
 PEAK FLOW RATE(CFS)    =     10.75
========================================================================
========================================================================
  END OF RATIONAL METHOD ANALYSIS
```



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

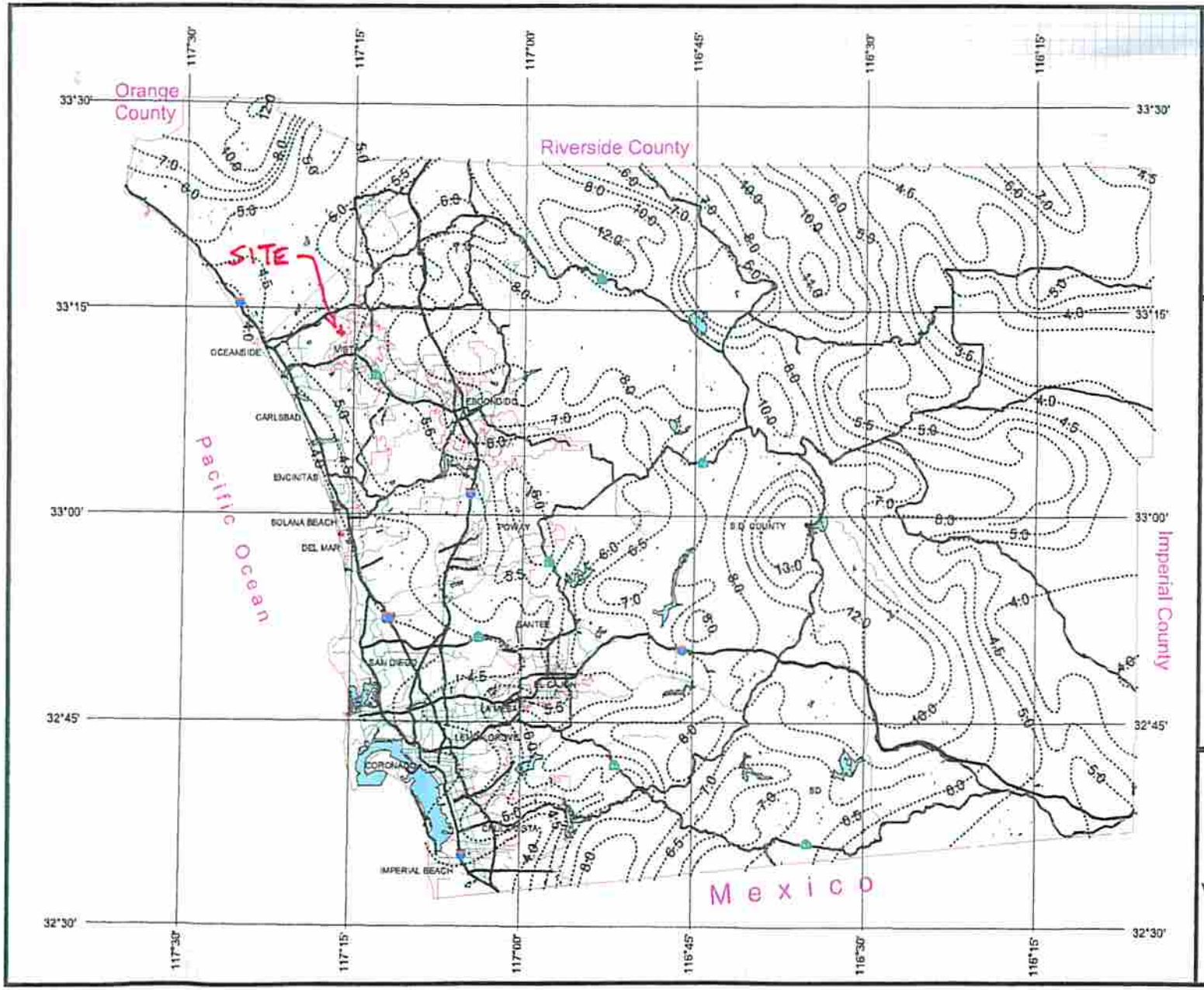
Isopluvial (Inches)

DPW GIS

SanGIS

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

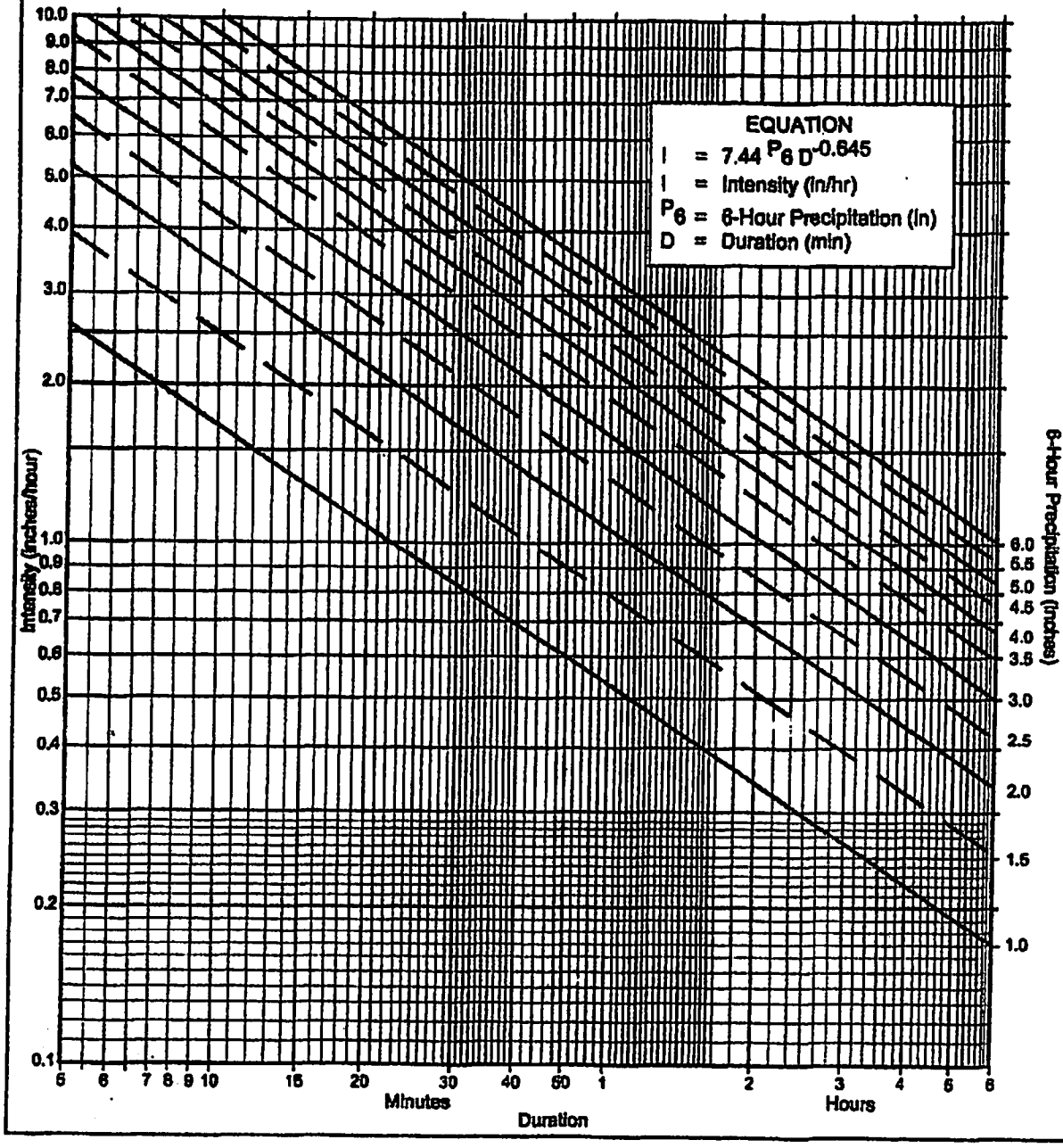
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.66	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

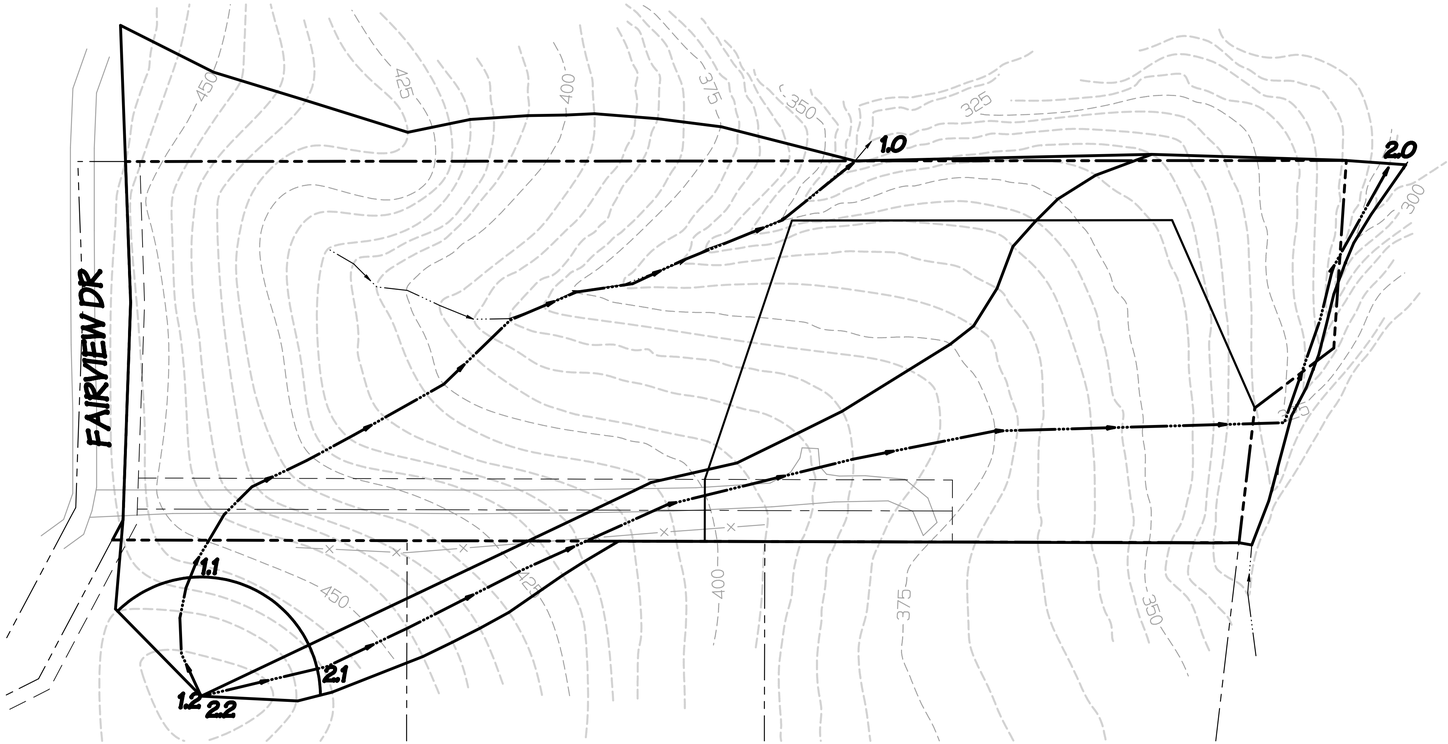
Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

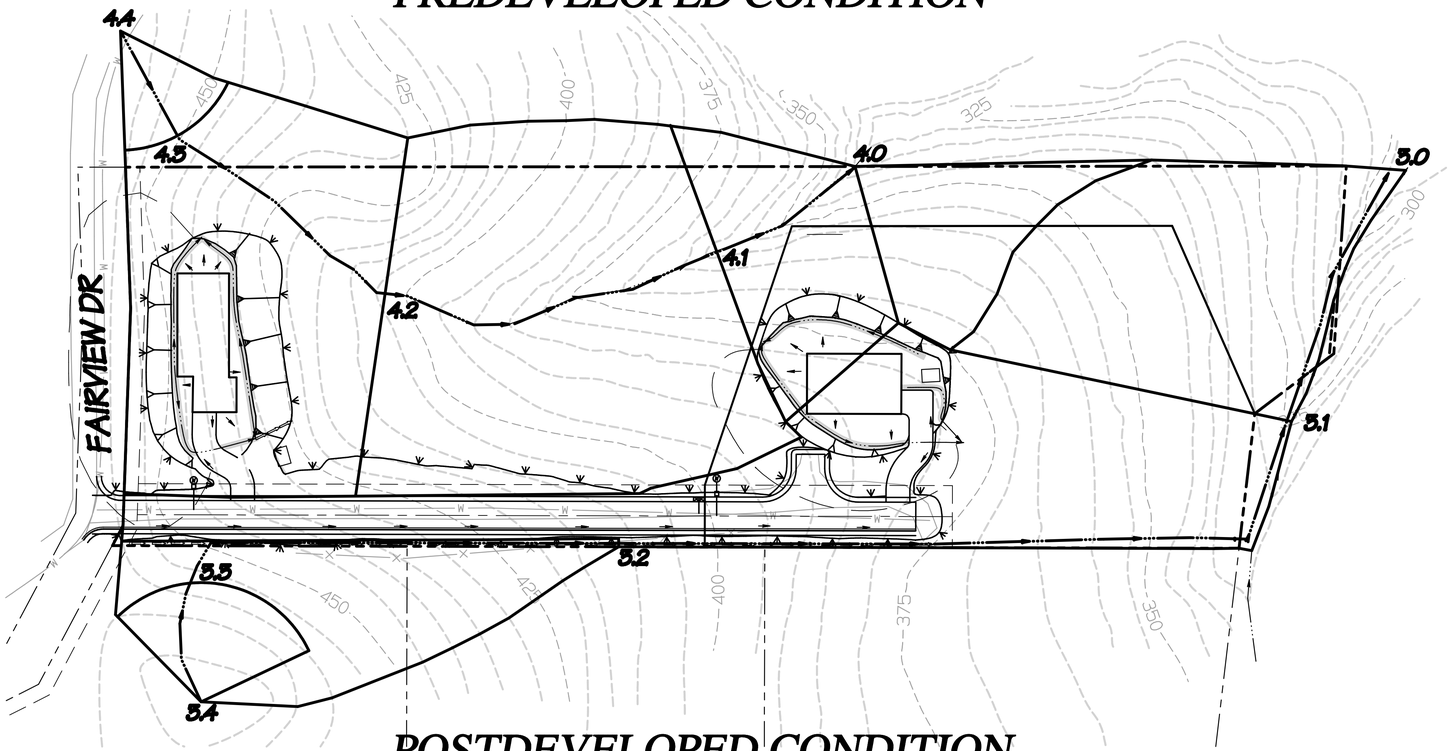
DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

VPM 107



PREDEVELOPED CONDITION



POSTDEVELOPED CONDITION

Wed Oct 07 14:55:03 2009N:\1104.pro

PE 1104

REGISTERED PROFESSIONAL ENGINEER
WILLIAM JUSTIN SUITER
No. 68964
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

REVISIONS:

W. JUSTIN SUITER, RCE 68964

PASCO LARET SUITER & ASSOCIATES
CIVIL ENGINEERING + LAND PLANNING + LAND SURVEYING
535 N Coast Highway 101 Ste A Solana Beach, CA 92075
ph 858.259.8212 | fx 858.259.4812 | plaesngineering.com

Hydrology Node Map For:

Kirkorowicz Property

Fairview Drive Property, Vista, CA 92083

A.P.N. 126-340-27

DESIGN: BMA/WJS

DRAWN: BMA

DATE: 8-16-06

SCALE: 1"=30'

SHEET 1 OF 1 SHEETS